

ALBERTA OIL SANDS INDUSTRY

QUARTERLY UPDATE

SPRING 2014

Reporting on the period: Dec. 06, 2013 to Mar. 17, 2014



Alberta
Government

All about the oil sands

Background of an important global resource

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Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada's 173 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 168 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called “easy” oil—continue to be depleted. The figure of 168 billion barrels of bitumen represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest-central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the “gum” to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

For the first time in 2012, in situ oil sands production exceeded mined oil sands production in Alberta. In 2012, 52 per cent of the province's oil sands volumes were produced using in situ

methods. Alberta will continue to rely to a greater extent on in situ production in the future, as 80 per cent of the province's proven bitumen reserves are too deep underground to recover using mining methods.

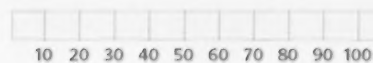
There are essentially two commercial methods of in situ (Latin for “in place,” essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and the melted bitumen flows into the lower well via gravity and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The selection is based on a number of factors, including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or “upgraded,” can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil, which is a refinery feedstock. That can be transformed into transportation fuels and other products. ■



100 KILOMETRES

Mapping the oil sands

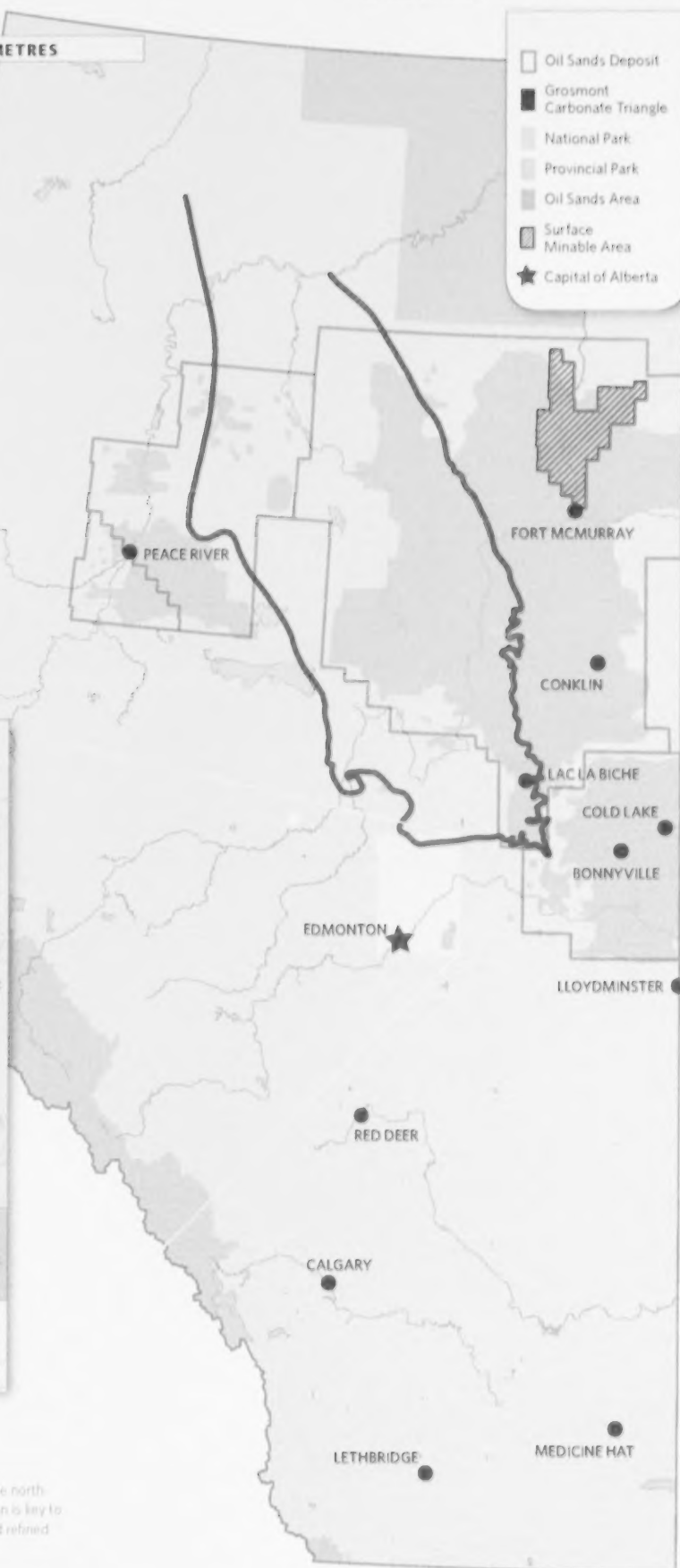
Canada's oil sands resources are often referred to as "the oil that technology made." Without intensive production technology development, the industry would not exist as it does today. These technologies still continue to be advanced and optimized, improving recovery and reducing environmental impacts.

ALBERTA'S INDUSTRIAL HEARTLAND



Alberta's Industrial Heartland is over 143,815 acres in size, and is located in the north-eastern quadrant of the greater Edmonton region in central Alberta. This region is key to the value-added processing of Alberta's oil sands resources into higher-valued refined petroleum products and petrochemicals.

- Oil Sands Deposit
- Grosmont Carbonate Triangle
- National Park
- Provincial Park
- Oil Sands Area
- Surface Mined Area
- Capital of Alberta



GOVERNMENT UPDATE



KEYSTONE XL: ALBERTA CONTINUES TO PUT FACTS ON THE TABLE

Premier Alison Redford issued the following statement on Alberta's National Interest Determination submission for the proposed Keystone XL Pipeline:

"We have been and remain confident in the merits of the Keystone XL pipeline project. Our submission to the U.S. State Department continues our sustained efforts to share Alberta's strong regulatory framework and proven track record in developing some of the world's most progressive environmental initiatives.

"We know the approval of Keystone XL will build upon the deep relationship between our countries and enable further progress toward a stronger, cleaner and more stable North American economy. This would certainly be in the interest of Albertans and, we respectfully believe, in the national interest of the United States.

"Alberta has always maintained that the facts need to be on the table in our face-to-face meetings with key decision makers in Washington and our submissions at each stage of the comprehensive review of this project. The U.S. State Department's final supplemental environmental impact statement recognized the work we're doing to protect the environment and explicitly mentioned the Alberta Lower Athabasca Regional Plan and the Specified Gas Emitter Regulation as examples.

"We are delivering on my government's promise to continue to advocate for important projects which support our long-term prosperity. As part of the Building Alberta Plan, we continue to build new markets for our products and services so we can keep investing in what matters most."

NEB APPROVES LINE 9B PROJECT WITH CONDITIONS

The National Energy Board (NEB) released in March the reasons for decision on the Line 9B Reversal and Line 9 Capacity Expansion Project application submitted by Enbridge Pipelines Inc. The board has approved the project, with conditions, but denied Enbridge's request for exemption from leave to open requirements.

The NEB's decision enables Enbridge to react to market forces and provide benefits to Canadians, while at the same time implementing the project in a safe and environmentally sensitive manner.

In its application, Enbridge requested approval from the board to reverse the direction of flow on a 639-kilometre segment of

pipeline located between North Westover, Ont., and Montreal, as well as approval to increase the overall capacity of the Line 9 pipeline from Sarnia, Ont., to Montreal from 240,000 barrels per day to 300,000 barrels per day. Enbridge also requested a revision to its Line 9 rules and regulations tariff to allow for the transportation of heavy crude oil.

As a result of the NEB's decision, Enbridge will be permitted to operate all of Line 9 in an eastward direction in order to transport crude oil from western Canada and the U.S. Bakken region to refineries in Ontario and Quebec.

Previously in a decision issued July 27, 2012, the board approved the reversal of the western portion of Line 9, a 194-kilometre segment linking Sarnia to North Westover.

During the board's hearing process, it heard concerns from participants regarding pipeline integrity, spills and emergency response, and Enbridge's consultation efforts.

The NEB's approval is subject to conditions set out in the orders and described in the accompanying reasons for decision. For example, the board's conditions require Enbridge to undertake activities regarding pipeline integrity, emergency response and continued consultation. The NEB's reasons for decision and conditions also make reference to Enbridge's ongoing emergency response planning and consultation with municipalities, first responders and aboriginal groups.

GOVERNMENT OF ALBERTA COMMITTED TO RESPONSIBLE ENERGY DEVELOPMENT

Environment and Sustainable Resource Development Minister Robin Campbell issued in March the following statement:

"The Canadian economy is driven by the natural resource sector in Alberta. It provides jobs and opportunities for communities and families across the country.

"The Government of Alberta has a strong regulatory system in place that protects the environment along with the health and safety of Albertans. Our government takes this responsibility seriously and companies that do not meet these standards will be held accountable.

"Our ability to open new markets for our oil—or to maintain the markets we have today—depends on our credibility when it comes to responsible oil sands development.

"Alberta is a leader when it comes to having stringent environmental monitoring, regulation and protection legislation. We are proud of this and remain committed to



ensuring that we develop our resources in a responsible and sustainable way.⁶

ALBERTA BALANCES BUDGET, FOCUSES ON ALBERTANS' PRIORITIES IN BUDGET 2014

Budget 2014 delivers a fully balanced budget focused on core areas that support families and communities—health, education and supports for the vulnerable—while continuing to build Alberta.

With \$1 billion in new operating funding for health, kindergarten to grade 12 (K-12), post-secondary education and human services to ease growth pressures, Budget 2014 implements the next phase of the Building Alberta Plan to invest in families and communities, live within our means, and open new markets for Alberta's resources for a stronger and more prosperous future.

While delivering an operational surplus of \$2.6 billion, Budget 2014 continues the government's commitment to fiscal responsibility by keeping operating expense growth below population plus inflation for a second year in a row. There are also no new taxes or tax increases.

Budget 2014 also implements a renewed purpose for Alberta's savings. Two new endowments within the Alberta Heritage Savings Trust Fund will encourage social and agricultural innovation. A new Alberta Future Fund will provide flexible funding for future strategic opportunities, offering long-term benefits to Albertans and the Alberta economy, and the Alberta Heritage Scholarship Fund will be enhanced to support students exploring opportunities in the trades.

As the next phase of the Building Alberta Plan, Budget 2014 will invest \$6.6 billion this year and \$19.2 billion over the next three years in essential infrastructure needed to support Alberta's exceptionally strong population growth. Alberta is expected to remain Canada's fastest-growing province in 2014 and 2015, growing by about 100,000 people each year.

Budget 2014 commits funding for 155 K-12 school projects, seven post-secondary projects, 24 health facility projects, 258 kilometres of new or twinned highways and 2,500 kilometres of rehabilitated highways over the next three years.

ALBERTA GIVES BUSINESSES FASTER ACCESS TO ECONOMIC INFO

The Alberta government is giving the province's businesses a new online tool to help them compete and succeed in Alberta's growing economy.

The [Economic Dashboard](#) provides 26 economic metrics specific to the Alberta economy and will be updated on a near-daily basis.

Metrics include indicators such as gross domestic product, natural resources prices and employment. The metrics also include historical time series charts that visually show performance over many years.

This user-friendly online tool translates to mobile devices and allows for easy, on-the-go access to valuable business information. The dashboard's data is available on the [Alberta Open Data Portal](#).

The dashboard is an example of the Alberta government's commitment to provide investors, businesses and Albertans with the best economic data in the most accessible format.

The dashboard replaces the long-standing Monthly Economic Review that documented available economic statistics in monthly hard copy and electronic formats.

ALBERTA INCREASES ENERGY TIES WITH CHINA

The Redford government is strengthening ties to the growing Chinese market and supporting Alberta companies as they expand internationally in the areas of environmental protection and responsible resource development.

A trade mission led by Cal Dallas, minister of international and intergovernmental relations, supports eight Alberta exhibitors in Beijing at the China International Petroleum & Petrochemical Technology and Equipment Exhibition (CIPPE)—the world's largest petroleum exhibition—and 10 delegates showcasing technologies, products and services at Alberta-China Environmental Technology Workshops in Chengdu, China, and Harbin, China on March 11-21.

Alberta companies exhibiting at CIPPE and delegates taking part in the workshops will all have opportunities to develop contacts; market technologies, products and services; and explore potential partnerships in China.

In 2013, industry that accessed Alberta services in Asia generated at least \$460 million in trade and investment. Alberta missions to China last fall resulted in the signing of the first ever provincial energy agreement with China. ■

LABOUR UPDATE



LABOUR MARKET INFORMATION

Alberta finished off 2013 with strong employment growth and is well-poised to build on these gains in 2014 due to continuing strong investment in the energy sector. Employment increased 3.2 per cent from January 2013 to January 2014. This led the country in growth and translated into 69,600 more people working in the province. The rise in employment was distributed between full- and part-time jobs, with over 97 per cent of jobs attributed to full-time work.

However, the labour force expanded by an even faster rate over the past year, with an increase of 75,900 people. As a result, the unemployment rate edged up slightly to 4.6 per cent, the lowest rate since October, and the second lowest in the country after Saskatchewan.

Due largely to the highest third-quarter net migration on record in 2013, Alberta led all provinces in population growth for the eleventh consecutive quarter. With the addition of 35,645 new residents between July and September of 2013, the province expanded its population by 0.89 per cent to 4,060,719 people. This was Alberta's highest third-quarter population growth rate since 2006, and it more than doubled Canada's growth of 0.39 per cent.

CHANGES TO THE TEMPORARY FOREIGN WORKER PROGRAM

It's important to know that the Government of Canada continues to reform the Temporary Foreign Worker Program to ensure Canadians are always first in line for available jobs, while temporary foreign workers are protected.

Effective Dec. 31, 2013, the federal government introduced changes that will:

- Provide the government with the authority to conduct inspections to make sure employers are meeting the conditions of the program;
- Allow the government to ban non-compliant employers from the program for two years and immediately add their names to a public ban list;
- Strengthen criteria for assessing Labour Market Opinion (LMO) and work permit applications; and
- Provide the government with the authority to revoke or suspend LMOs or refuse to process LMO applications, and to revoke and refuse to process work permits if necessary.

For more information on the new regulations, visit the federal government [website](http://www.cic.gc.ca).

ALBERTA ECONOMIC DASHBOARD

Tap into the latest Alberta economic information with the [Alberta Economic Dashboard](http://alberta.ca/economic-dashboard).

This new online business information source presents timely and vital economic statistics in user-friendly formats to help your organization better understand Alberta's business environment. From job vacancies and housing starts, to new motor vehicle sales and net migration, this forward-thinking project is the first of its kind in Canada.

The [dashboard](http://alberta.ca/economic-dashboard) provides 26 economic metrics specific to the Alberta economy and will be updated on a near-daily basis.

2013 ALBERTA WAGE AND SALARY SURVEY

The recently released [2013 Alberta wage and salary survey](http://alberta.ca/wage-and-salary-survey) provides information on wages and salaries for full-time and part-time employees in Alberta by occupation, geographic area and industry group. This information can help you make informed compensation decisions and assist in developing competitive hiring policies.

U.S. RECRUITING FACT SHEET

Are you recruiting internationally but have no idea where to start? The [U.S. recruiting fact sheet](http://alberta.ca/recruiting-fact-sheet) provides information on the labour supply, migration trends, credential recognition and recruitment tips to help you make informed recruitment decisions.

NEW LABOUR MARKET INFORMATION

The Alberta government recently released updated versions of both the [Short-Term Employment Forecast](http://alberta.ca/short-term-employment-forecast) and the [Occupational Demand and Supply Outlook](http://alberta.ca/occupational-demand-and-supply-outlook). These resources can help you make decisions about future staffing programs and resources on a per-occupation basis.

CONTACT US

Contact us with questions or concerns or for more information at ABV/workforceinfo@gov.ab.ca.



What's new in the oil sands

BUSINESS



■ The estimated cost of the upgrader/refinery that will convert some of Alberta's royalty bitumen into diesel fuel has ballooned to \$8.5 billion from the \$5.7-billion price tag cited when the project was sanctioned in 2012.

North West Redwater Partnership—a 50/50 joint venture between North West Upgrading Inc. and Canadian Natural Resources Limited—says the target for starting commercial operations at the 50,000-barrel-per-day plant has also been moved to September 2017 from the original forecast of mid-2016.

A portion of the Alberta government's royalty bitumen—royalties collected as actual bitumen in lieu of cash royalties—will provide 75 per cent of the upgrader/refinery's feedstock. In situ bitumen production from Canadian Natural will make up the other 25 per cent.

In announcing its budget and schedule overrun, North West Redwater says detailed engineering is well advanced on many process units, firm contractor quotes have been received, material takeoffs have been finalized, certain larger contracts have been signed and site preparation has begun.

■ Saipem Canada Inc. has opened the largest indoor modular fabrication facility in Canada.

The new 19,000-square-metre facility opened on the company's 20-hectare site in northeastern Edmonton in late November. By combining pipe fabrication, plate cutting and module erection under one roof, the company plans to produce 240 modules per year. At any given time, the facility can house 16-20 modules, with space for another 42-45 in the yard outside.

■ Shell Canada Limited's 100,000-barrel-per-day Jackpine Mine Expansion project has been approved by the federal cabinet, despite federal Environment Minister Leona Aglukkaq finding the project likely to cause significant adverse environmental effects.

Those effects are justified in the circumstances, the federal government said in its approval of the project. The decision

includes mitigation measures and follow-up program requirements that Shell must implement.

■ Statoil Canada Ltd. and Thai exploration and production company PTT Exploration and Production Public Company Limited (PTTEP) are splitting up their shared Kai Kos Dehseh steam-assisted gravity drainage project.

Statoil will continue as operator and now 100 per cent owner of the Leismer and Corner projects, while PTTEP will own 100 per cent of the Thornbury, Hangingstone and South Leismer areas. Leismer is the only operating asset, currently about 10,000 barrels per day.

Statoil will pay US\$435 million to PTTEP, which includes US\$235 million in a working capital adjustment effective Jan. 1, 2013. The completion of the transaction is subject to customary regulatory approvals in Canada and is expected to close by the third quarter of 2014.

■ Enbridge Inc. is planning additional facilities at its Sunday Creek terminal to support rising production from Cenovus Energy Inc.'s Christina Lake project.

Priced at \$200 million, the expansion includes development work on a site next to the terminal's current location and a 350,000-barrel tank with associated piping, pumps and measurement equipment. Enbridge will do civil work on a future tank as well.

The new facilities will be in service in the third quarter of 2015, the company says.

■ Jacobs Engineering Group Inc. has won a two-year oil sands and plant services contract for the Suncor Energy Inc. base plant.

Under the contract, Jacobs will help manage and support plant maintenance processes. Over the past four years, the company has taken part in seven turnarounds at the Suncor facility. ■

What's new in the oil sands

TECHNOLOGY



Two new pilot projects could benefit the oil sands sector—one by reducing the cost of hydrogen needed for upgrading, and the other by removing the need for diluent.

In mid-December, Western Hydrogen Ltd. officially opened its molten salt gasification pilot plant in Fort Saskatchewan, Alta. The process uses water and a carbonaceous feedstock—such as petroleum coke or asphalt—to produce hydrogen and compressed CO₂, which can be sequestered or used in enhanced oil recovery.

Western Hydrogen is also linked to Field Upgrading Ltd., which plans to open a pilot project to develop molten sodium bitumen upgrading. The process will break down bitumen, extracting the sulphur and heavy metals. The end result is oil that is light enough to transport without diluent. The project will be built adjacent to the Western Hydrogen pilot by the end of this year and is expected to be operational by the first quarter of 2015.

Enbridge Inc. and TransCanada Corporation have signed a \$4-million joint industry partnership agreement to conduct research on pipeline leak detection.

As part of the agreement, both companies will fund research conducted at an Edmonton facility to improve external leak detection. TransCanada and Enbridge will contribute \$1.3 million and \$1.6 million, respectively, to the partnership, while Alberta Innovation and Advanced Education will provide \$1.1 million.

Any advancements that come out of the research will be shared by both companies.

A pilot project designed to upgrade bitumen emulsion directly from the wellhead has received regulatory approval, but it's not clear yet when construction will begin. The proponent, Value Creation Inc., says it is funded to move forward at any time.

The TriStar project has a design capacity of 1,000 barrels per day of bitumen from two steam-assisted gravity drainage well pairs. The plan is to take the bitumen and water emulsion directly from the wellhead and use Value Creation's proprietary

upgrading technology to convert the bitumen to about 870 barrels per day of synthetic crude oil.

The pilot would be built on Value Creation's TriStar lands about 14 kilometres south of Fort McMurray and four kilometres east of Highway 63.

BA Energy Inc. has filed with the Alberta Energy Regulator and Alberta Environment and Sustainable Resource Development to amend its Heartland upgrader project proposal.

The company wants to modify the upgrader's conversion process to produce medium crudes. According to BA Energy, the plan is better suited to the changing North American refining market, where light and extra-heavy crudes are abundant, while medium crude supplies are declining.

The changes all fit within the previously approved project area in Strathcona County and would offer lower costs, reduced emissions and better environmental performance, the company says. Timing for project sanction remains uncertain.

At Seal in the Peace River oil sands, Murphy Oil Corporation is continuing to focus on its enhanced oil recovery projects, with recent work centred on steam.

The company's cyclic steam stimulation pilot project continues to show promise with two initial wells, according to Roger Jenkins, president and chief executive officer.

Jenkins says he is more excited about the second well than the first, which had some mechanical issues in the completion. The second well is currently producing in its third cycle and showing the best response to date, with production rates as high as 670 barrels of oil per day.

"The steam-oil ratio continued to improve in the previous cycle in this well, reporting an impressive steam-oil ratio of 1.8," he says.

Murphy expects to receive regulatory approval for a third well in the second quarter and would be ready to inject steam in the third quarter. ■

OIL SANDS PROJECT TECHNOLOGY GUIDE

CSS—CYCLIC STEAM STIMULATION

CSS involves injecting high-pressure steam into the reservoir for several weeks, followed by several weeks where the reservoir is left to "soak." The heat softens the bitumen and the water dilutes and separates the bitumen from the sand. The pressure creates cracks and openings through which the bitumen can flow back into the steam injector wells, which are converted to production mode.

ET-DSP—ELECTRO-THERMAL DYNAMIC STRIPPING (EMERGING)

Electrodes are placed in a grid configuration and a production well is located within the centre of each series of electrode wells.

PRIMARY PRODUCTION—COLD HEAVY OIL PRODUCTION WITH SAND

Cold heavy oil production with sand (CHOPS) is a non-thermal in situ primary production technology that involves the continuous production of sand using progressing cavity pumps to enhance recovery.

SAGD—STEAM ASSISTED GRAVITY DRAINAGE

SAGD employs two parallel horizontal wells: one injection well near the top of the reservoir, through which high-pressure steam is continuously injected, and one production well near the bottom of the reservoir into which the softened bitumen continuously flows and can be pumped to the surface. SAGD surface facilities include steam generation, water processing and bitumen treatment.

SOLVENT INJECTION/CO-INJECTION

Solvent injection or co-injection with steam is seen as one of the most promising incremental enhancements to the steam assisted gravity drainage (SAGD) process. In solvent co-injection, it is projected that hot vapour solvents carried by steam can penetrate deeper into the warm bitumen zone than steam alone. This results in a thicker mobilization layer and a larger bitumen flow along the SAGD chamber wall and increased production with lower greenhouse gas emissions. Solvent injection/co-injection technologies include: bitumen extraction solvent technology (BEST), solvent aided process (SAP) and solvent cyclic SAGD (SC SAGD).

SURFACE MINING

Trucks take oil sand to crushers where it is prepared for extraction. Crushed oil sand is mixed with warm water and fed through a hydraulic transport system to an extraction plant where the mixture of oil, sand and water is placed in separation vessels. Injected air forms tiny bubbles that separate bitumen from the sand and floats it to the tank surface where it forms a thick froth that is skimmed off, mixed with naphtha and spun in a centrifuge to remove the remaining solids, water and dissolved salts. The cleaned sand and the water are then sent to the tailings area where the water is recycled back to the extraction process.

TAGD—THERMAL ASSISTED GRAVITY DRAINAGE (EMERGING)

TAGD is a process being developed for the in situ recovery of bitumen from carbonate formations. TAGD uses an array of downhole heaters installed in horizontal wells to heat the reservoir via thermal conduction.

THAI—TOE TO HEEL AIR INJECTION (EMERGING)

THAI uses a vertical air injection well with a horizontal production well. Rather than steam, THAI technology injects air and then relies on underground combustion of a portion of the oil in the ground to generate the heat required to melt the remainder of the bitumen and allow it to flow into the production well. The process is intended to reduce greenhouse gas emissions and water use.

UPGRADING

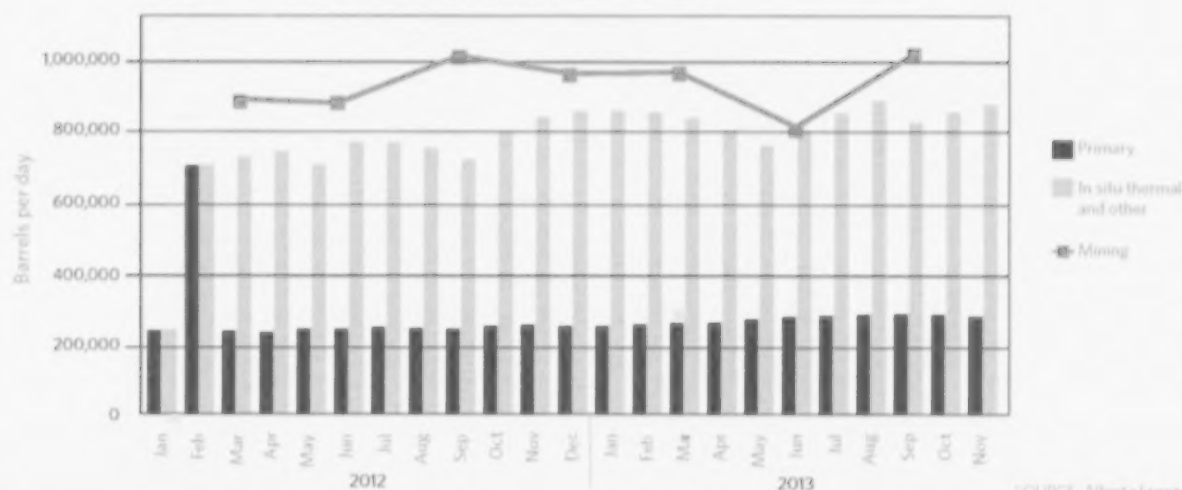
Once bitumen is produced, it is sent for further upgrading, a process that breaks down the heavy carbon molecules and converts it into a product similar to conventional crude oil. This can be processed by refiners into value-added products.

VSD—VERTICAL STEAM DRIVE

Vertical steam drive incorporates the creation of hexagonal well patterns. At Carmon Creek, Shell plans to drill six vertical production wells in a hexagonal pattern, with one dedicated steam injector well in the centre. The goal of this recovery method is to drive fluid horizontally from the steam injector well to the producer wells, without relying on gravity or vertical flow, and to operate at low pressures.

SOURCE: Climate Change and Emissions Management Corporation/Oil Sands Developers Group/Edmonton Review

Alberta Oil Sands Production by Extraction Method



SOURCE: Alberta Energy Regulator

Project listings

Updated status of oil sands projects in Alberta as of February 2014

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABASCA REGION - MINING				
CANADIAN NATURAL RESOURCES LIMITED				
Horizon				
Canadian Natural says that operating performance at Horizon has been strong since the company awarded its first major turnkey contract in May 2013. Horizon SCO production in the third quarter was approximately 102,000 barrels per day. The overall phased expansion to 240,000 barrels per day is 90 per cent physically complete, with the first phase in that expansion, Reliability, 90 per cent physically complete and five per cent under budget.				
Phase 1	150,000	2008	Approved	Mining
Reliability - Franchise 2	5,000	2014	Approved	Mining
Phase 2B	40,000	2016	Approved	Mining
Phase 2C	45,000	2016	Approved	Mining
Phase 3	80,000	2017	Approved	Mining
IMPERIAL OIL LIMITED				
Reed				
Imperial Oil says that Reed gross oil-sand production continues to ramp up. Production was impacted during the fourth quarter by harsh winter weather and equipment reliability issues that are being addressed. Production rates of 100,000 barrels per day have been reached, and ongoing efforts to stabilize performance at these higher levels are progressing. The Reed expansion project was 72 per cent complete at year end and remains on target for a 2015 start-up.				
Phase 1	80,000	2015	Approved	Mining
Phase 2	80,000	2016	Approved	Mining
Phase 3	80,000	2017	Approved	Mining
Phase 4 (Defoliation)	45,000	TBD	Approved	Mining
SHELL ALBERTA SANDS				
Jackpine				
The federal joint review panel has issued conditional approval despite "significant" environmental impacts. How the project will go through the Alberta regulatory process and obtain approval from the federal environment minister.				
Phase 1A	80,000	2010	Approved	Mining
Phase 1B	80,000	TBD	Approved	Mining
Expansion	80,000	2017	Approved	Mining
Mountain River				
Mountwest partner Marathon Oil Corporation says the Athabasca Oil Sands Project has monthly shown "outstanding" performance due to robust reliability and maintenance, but is expecting significant planned downtime in the fourth quarter.				
Commercial	10,000	2002	Approved	Mining
Expansion & Defoliation	10,000	TBD	Approved	Mining
Pierre River				
A joint review panel of the Canadian Environmental Assessment Agency and Alberta Energy Regulator has conducted a public comment period and is now considering comments and determining the adequacy of information to proceed to hearings.				
Phase 1	100,000	2016	Approved	Mining
Phase 2	100,000	TBD	Approved	Mining
SUNCOR ENERGY INC.				
Base Operations				
Suncor says that production was reduced in September as a result of planned maintenance at the Upgrader 2 process tower and related units, which was successfully completed in October. Suncor says this marks the completion of major planned maintenance activities for the year and sets the foundation for a strong fourth quarter.				
Millwright Mine	24,000	1967	Approved	Mining
Sheepskin (Defoliation) Phase 1	4,000	2007	Approved	Mining
Millwright (Defoliation)	25,000	2008	Approved	Mining
North Sheepskin Extension	80,000	2012	Approved	Mining
Fort Hills				
Suncor and its partners have sanctioned the Fort Hills project.				
Phase 1	100,000	2014	Approved	Mining
Defoliation	30,000	TBD	Approved	Mining
Voyageur South				
Suncor considers Voyageur South to be a "longer term" project and has not confirmed a start-up date.				
Phase 1	120,000	TBD	Approved	Mining
SYNCRUDE CANADA LTD.				
Mildred Lake/Aurora				
Canadian Oil Sands Limited says that Synkrude has completed construction of two of four major capital projects designed for support operations and environmental performance. At the Aurora North site, two of three mine trains have been allocated to enable the placement of consolidated tailings in pit, and a new conveyor tailings plant has been constructed.				
Base Mine Stage 1 & 2 Expansion	290,000	2016	Approved	Mining

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Stage 1 Expansion	110,000	2008	Approved	Mining
Conveying Tailings Management	TBD	TBD	Approved	Mining
Aurora South Train 1	600,000	2016	Approved	Mining
Aurora South Train 2	600,000	2018	Approved	Mining
Mildred Lake Mine 1 extension (MLC)	TBD	2017	Approved	Mining
TECK RESOURCES LIMITED				
Frontier				
The Canadian Environmental Assessment Agency estimates the federal review schedule for the project application to be approximately two years, in 2015 would be the earliest approval would be granted. Teck expects to have a project update available in the fourth quarter.				
Phase 1	74,000	2021	Approved	Mining
Phase 2	84,000	2024	Approved	Mining
Phase 3	79,000	2027	Approved	Mining
Phase 4 & 5 (pilot)	39,400	2030	Approved	Mining
TOTAL E&P CANADA LTD.				
Jasper North Mine				
Project partner Suncor Energy Inc. says an updated timing for the Jasper mine has been set for early 2014, when it is ready.				
Phase 1	600,000	2015	Approved	Mining
NORTH ATHABASCA REGION - IN SITU				
ATHABASCA OIL CORPORATION				
Bioch				
Athabasca says its work at Bioch currently relates to regulatory compliance and preliminary engineering on future site access infrastructure. The company is currently reviewing the optimal use of the first project.				
Phase 1	12,000	TBD	Approved	ISAGO
Down West Carbonates (Leduc)				
A fourth production cycle for the Leduc pilot test is scheduled for the fourth quarter of 2013. Athabasca has been encouraged by results so far.				
Phase 1 Demonstration	6,000	2016	Approved	ISAGO
Phase 2 Demonstration	6,000	TBD	Approved	ISAGO
Down West Sands & Clastics				
Athabasca is currently awaiting regulatory approval for the Down West Sands (Phase 1).				
Phase 1	12,000	2016	Approved	ISAGO
Phase 2	15,000	2018	Approved	ISAGO
Phase 3	15,000	2020	Approved	ISAGO
Phase 4	15,000	2022	Approved	ISAGO
Phase 5	15,000	2024	Approved	ISAGO
BP PLC				
Terra de Gass				
BP says that ongoing approval activities include defoliation drilling, seismic geophysics and approval of water sources.				
Plant	10,000	TBD	Approved	ISAGO
BRON ENERGY CORPORATION				
Downer				
The Fort McKay Field Plant has been granted leave to appeal the recently granted regulatory approval of the Downer process, based on the Field Plant's desire to have a better zone isolated between the project and land used for traditional purposes.				
Downer North Phase 1	10,000	2016	Approved	ISAGO
Downer North Phase 2	10,000	2018	Approved	ISAGO
Downer South Phase 1	10,000	2017	Approved	ISAGO
Downer South Phase 4	10,000	2017	Approved	ISAGO
Downer South Phase 5	10,000	2018	Approved	ISAGO
MacKay River				
Phase 1	10,000	2016	Approved	ISAGO
Phase 2	10,000	2018	Approved	ISAGO
Phase 3	10,000	2020	Approved	ISAGO
Phase 4	10,000	2022	Approved	ISAGO
CANADIAN NATURAL RESOURCES LIMITED				
Bird Mountain				
Canadian Natural says Bird is in the planning stages.				
Phase 1	100,000	2018	Approved	ISAGO
Phase 2	100,000	2021	Approved	ISAGO

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
ENOVUS ENERGY INC.				
East McMuray				
Enovus says this project remains part of its portfolio of long-term development opportunities.				
Phase 1	30,000	TBD	Completed	SAUD
Stephamb				
Enovus says this project remains part of its portfolio of long-term development opportunities.				
Phase 1	30,000	TBD	Completed	SAUD
Telephone Lake				
Enovus says its downstream pilot project designed to remove an underground layer of non-petroleum water sitting on top of the oil sands deposit at Telephone Lake has been running successfully and has delivered approximately 45 per cent of the top water separating it with air. The company plans to scale the pilot commercially.				
Phase A	40,000	TBD	Completed	SAUD
Phase B	40,000	TBD	Completed	SAUD
E-T ENERGY LTD.				
Papier Creek				
The E-T Energy Papier Creek pilot project is no longer operating, but the expanded field trial is able to proceed, subject to regulatory approval and financing.				
Experimental Pilot	1,000	2012	Completed	ET-GP
Phase 1	30,000	TBD	Completed	ET-GP
Phase 2	40,000	TBD	Completed	ET-GP
GAZZELY OIL SANDS LLC				
Thickwood				
The Alberta Energy Regulator says it will deliver decisions on applications for in situ oil sands projects in the new "shadow thermal zone" of the Athabasca region until it has developed formal regulatory requirements. Gasky Thickwood is one of the targeted projects.				
Phase 1	4,000	2012	Completed	CO-SAUD
Phase 2	6,000	TBD	Completed	CO-SAUD
HUSKY ENERGY INC.				
Selkirk				
Husky filed its regulatory application for its Selkirk pilot in early May 2013.				
Experimental Pilot	1,000	2012	Completed	ET-GP
Sunrise				
Husky says that Sunrise remains on target for first oil production in late 2014. Field trials are now complete and commercialization of all rights will go forward to be funded by gas work. The overall project is approximately 85 per cent complete. The company has also filed an environmental application for Phase 2 to incorporate efficiencies learned from Phase 1. The next phase, which is subject to company and partner approvals, will bring total production capacity to 300,000 barrels per day. It is anticipated Phase 2 will be developed in two 150,000 barrel per day capacity stages.				
Phase 1	40,000	2014	Completed	SAUD
Phase 2A	30,000	2016	Completed	SAUD
Phase 2B	30,000	2016	Completed	SAUD
IMPERIAL OIL LIMITED				
Aspen				
Imperial Oil has filed its regulatory application for the Aspen project, which it says will be developed in three phases that will follow Imperial's "design, build, operate" approach. A final investment decision could be made by its vote in 2017, and the project could be producing as early as 2020.				
Phase 1	45,000	2020	Completed	SAUD
Phase 2	45,000	TBD	Completed	SAUD
Phase 3	45,000	TBD	Completed	SAUD
IRVING ENERGY INC.				
Tamworth				
The Alberta Energy Regulator says it will deliver decisions on applications for in situ oil sands projects in the new "shadow thermal zone" of the Athabasca region until it has developed formal regulatory requirements. Irving Tamworth is one of the targeted projects.				
Phase 1	20,000	2012	Completed	SAUD
Phase 2	20,000	TBD	Completed	SAUD
MARATHON OIL CORPORATION				
Richwood				
Marathon filed its regulatory application in 2012. Regulatory approval and project construction are expected in 2013.				
Construction	12,000	2012	Completed	SAUD
OAK POINT ENERGY LTD.				
Levis				
The AER and Alberta Environment have approved Oak Point's Levis project, which is scheduled to cost \$45 million.				
Pilot	1,700	TBD	Completed	SAUD
PREPPER PETROLEUM LTD.				
Rigel				
Prepper Petroleum filed its regulatory application for the Rigel SAUD project in November 2013.				
Phase 1	6,000	2012	Completed	SAUD
SILVERWILLOW ENERGY CORPORATION				
Audet				
The Alberta Energy Regulator says it will deliver decisions on applications for in situ oil sands projects in the new "shadow thermal zone" of the Athabasca region until it has developed formal regulatory requirements. SilverWillow Audet is one of the targeted projects.				
Pilot	1,000	2016	Completed	SAUD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
SOUTHERN ENERGY RESOURCES CORP.				
STP-Murray				
The Alberta Energy Regulator says it will deliver decisions on applications for in situ oil sands projects in the new "shadow thermal zone" of the Athabasca region until it has developed formal regulatory requirements. Southern Energy's STP-Murray is one of the targeted projects.				
Phase 1	50,000	2012	Completed	SAUD
Phase 1.5 expansion	4,000	2016	Completed	SAUD
Phase 2A	50,000	2016	Completed	SAUD
Phase 2B	50,000	2016	Completed	SAUD
SUNION ENERGY INC.				
Dave				
St. John says that while a currently being completed into the Dave to open a path between the Dave and the Dave and the Dave will provide a path for Dave to open a path between the Dave and the Dave in the first quarter of 2014. Operations will continue until 2015.				
Construction Phase	300	2013	Completed	WST
Finlay				
General says that production at Finlay continued to ramp up in the first quarter and increased 10 per cent over the prior year quarter to 100,000 barrels per day from 90,000 barrels per day in the third quarter of 2012. The company says it remains on track to reach full design capacity of 180,000 barrels per day by early in 2014. General does not expect to proceed with Stage 3 and 4 in favour of diversifying existing infrastructure.				
Stage 1	30,000	2004	Completed	SAUD
Stage 2	30,000	2006	Completed	SAUD
Expansion and Extension	20,000	2009	Completed	SAUD
Stage 3	40,000	2011	Completed	SAUD
Stage 4	40,000	2012	Completed	SAUD
Stage 5	40,000	2016	Completed	SAUD
Stage 6	40,000	2016	Completed	SAUD
Stage 7 & Development	20,000	TBD	Completed	SAUD
Levis				
After the Mackay River expansion and debottlenecking at both Levis and Mackay River Levis is expected to be General's next area of its development focus.				
Phase 1	40,000	TBD	Completed	SAUD
Phase 2	40,000	TBD	Completed	SAUD
Mackay River				
General says Mackay River production volumes increased to 75,000 barrels per day in the third quarter of 2013, compared to 10,000 barrels per day in the third quarter of 2012, due to maintenance of the central processing facility and the third party expansion work in the pilot area. The company continues to host a 2014 campaign for the Mackay River expansion and is the developer expects to increase production by approximately 30 per cent post the next two years through debottlenecking.				
Phase 1	10,000	2012	Completed	SAUD
Expansion 2	5,000	TBD	Completed	SAUD
API	10,000	2012	Completed	SAUD
SUNSHINE OIL SANDS LTD.				
Harper				
Experimental Pilot				
1,000	TBD	Completed	ET-GP	
Legend Lake				
Sunshine says regulatory approval for the first 10,000 barrel per day phase is expected in 2013. The company is completing field work for its environmental analysis, which will support work for regulatory submission requirements.				
Phase A1	10,000	2016	Completed	SAUD
Phase A2	10,000	TBD	Completed	SAUD
Phase B1	10,000	TBD	Completed	SAUD
Phase B2	10,000	TBD	Completed	SAUD
Thickwood				
Sunshine says regulatory approval is anticipated in the third quarter of 2013. The company has filed its proposed terms of reference with Alberta Environment for a phased expansion of Thickwood to approximately 40,000 barrels per day.				
Phase A1	10,000	2016	Completed	SAUD
Phase A2	10,000	2017	Completed	SAUD
Phase B	10,000	2019	Completed	SAUD
West Elm				
Sunshine says that some of the work on the West Elm site has been slowed down temporarily as the company needs additional funding.				
Phase A1	5,000	2014	Completed	SAUD
Phase A2	5,000	2014	Completed	SAUD
Phase A3	10,000	2016	Completed	SAUD
Phase B	10,000	2017	Completed	SAUD
Phase C1	10,000	TBD	Completed	SAUD
Phase C2	10,000	TBD	Completed	SAUD
ALBERTA OIL SANDS INC.				
Charlton West				
Alberta Oil Sands has announced its oil sands leases near the East McMuray airport will be converted, saving out the company's Clearwater West project.				
Phase 1/2/3/4	4,000	TBD	Completed	SAUD
Phase 5	20,000	TBD	Completed	SAUD

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
ATHABASCA OIL CORPORATION				
Hanging Rock				
Husky says that construction at Hanging Rock is nearly half complete and remains on budget with up to 10% to be left for test stream in the fourth quarter of 2014.				
Phase 1	40,000	2014	Approved	SAO
Phase 2	40,000	2015	Approved	SAO
Phase 3	40,000	2016	Approved	SAO
BLACKHILL RESOURCES INC.				
Blackfoot				
Blackfoot says that results from the SAO pilot continue to meet expectations, and commercial production from the pilot has reached 200,000 barrels of oil. Stream injection in the ground well-pipe commenced in early November.				
Phase 1	300	2014	Approved	SAO
Phase 2	20,000	2016	Approved	SAO
Phase 3	30,000	2018	Approved	SAO
Phase 4	40,000	2019	Approved	SAO
CANADIAN NATURAL RESOURCES LIMITED				
Gregory Lake				
Canadian Natural says Gregory Lake is in the planning stages.				
Phase 1	60,000	2015	Approved	SAO
Phase 2	60,000	2016	Approved	SAO
Grout				
Canadian Natural says Grout is in the planning stages. First similar trial is expected between 2017 and 2018.				
Commercial	50,000	2018	Approved	SAO
Kelly				
Canadian Natural says that Kelly is in the planning stages. Kelly is a 100,000 barrel per day oil sand processing plant. Canadian Natural says the well requires a permitting as expected and production is targeted to grow to 40,000 barrels per day in the fourth quarter of 2014. All regulatory, design, construction and testing activities are in progress, and the first shipment of crude oil produced from commercial processing will be delivered in May 2015.				
K1 - Kelly South	40,000	2015	Approved	SAO
K2 - Kelly North	40,000	2016	Approved	SAO
K3 - Kelly North	40,000	2016	Approved	SAO
CANADIAN ENERGY INC.				
Husky				
Canadian Energy says that construction and design for Phase 1 is underway, along with geotechnical work and drilling of additional source water and disposal wells. The company will begin regulatory approval for Phase 2 and continues to evaluate funding alternatives.				
Phase 1	10,000	2015	Approved	SAO
Phase 2	10,000	2016	Approved	SAO
Phase 3	10,000	2016	Approved	SAO
CENOVUS ENERGY INC.				
Chinook Lake				
Cenovus says the Phase 1 expansion is on schedule and on budget with about 17 per cent of the project complete and pre-construction, pilot construction and engineering work continuing. Engineering work also continues for Phase 2.				
Phase 1A	40,000	2013	Approved	SAO
Phase 1B	40,000	2014	Approved	SAO
Phase 1C	40,000	2015	Approved	SAO
Phase 1D	40,000	2016	Approved	SAO
Phase 1E	40,000	2017	Approved	SAO
Optimization (Phase 1C, D, E)	10,000	2016	Approved	SAO
Phase 2	10,000	2016	Approved	SAO
Phase 3	10,000	2017	Approved	SAO
Phase 4	10,000	2018	Approved	SAO
Foster Creek				
Cenovus says Phase 1 is on schedule and on budget with 40 per cent of the project complete. Phase 2 is 60 per cent complete, and Phase 3 is 27 per cent complete.				
Phase A	20,000	2013	Approved	SAO
Phase B (Construction)	4,000	2013	Approved	SAO
Phase C - Stage 1	10,000	2015	Approved	SAO
Phase C - Stage 2	10,000	2017	Approved	SAO
Phase D	10,000	2019	Approved	SAO
Phase E	10,000	2019	Approved	SAO
Phase F	10,000	2019	Approved	SAO
Phase G	10,000	2019	Approved	SAO
Phase H	10,000	2019	Approved	SAO
Phase I	10,000	2019	Approved	SAO
Phase J	10,000	2019	Approved	SAO
Future Optimization	10,000	2019	Approved	SAO
Grand Rapids				
Cenovus completed a turnaround at Grand Rapids in the third quarter to increase facility capacity, affecting production on both well pads in the first half of 2013. If regulatory application and EIA for the 100,000 barrel per day commercial project has been submitted and Cenovus will begin receiving regulatory approval within the next few months.				
Phase A	600	2013	Approved	SAO
Phase B	60,000	2017	Approved	SAO

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
Phase 1				
Phase 1	40,000	2015	Approved	SAO
Norman Lake				
Cenovus says pilot construction began in August.				
Phase A	40,000	2015	Approved	SAO
Phase B	40,000	2016	Approved	SAO
Phase C	40,000	2016	Approved	SAO
West Kirby				
Cenovus says this project remains part of its portfolio of long-term development opportunities.				
Phase 1	30,000	2015	Approved	SAO
Winifred Lake				
Phase 1	40,000	2015	Approved	SAO
ENSCO LIMITED				
Long Lake				
Phase 1	10,000	2014	Approved	SAO
Phase 2 (A/B)	40,000	2015	Approved	SAO
Phase 3 (A/B)	40,000	2016	Approved	SAO
CONRAD OIL AND GAS LIMITED				
Good Divide				
Conrad says that the new 100 wells at Good Divide are on production and averaged 1,000 barrels per day in December. Phase 1 is on track to start up 10,000 wells with construction continuing through the end of the fourth quarter 2014 and into early January. All of the wells are on production.				
Phase 1	10,000	2015	Approved	SAO
Phase 2	10,000	2016	Approved	SAO
Phase 3	10,000	2016	Approved	SAO
Phase 4	10,000	2016	Approved	SAO
CONCORDIA ENERGY CANADA				
Summit				
Concordia says that on the Summit expansion, engineering is complete, and 4,000 employees and contractors are on-site, and construction is about 10 per cent complete. The company continues to seek buyers for a significant portion of its oil sands assets and operations, including its 50 per cent stake in the Summit project. The company says the process will extend into 2014.				
Phase 1	1,000	2015	Approved	SAO
Phase 2	10,000	2017	Approved	SAO
Phase 3	10,000	2018	Approved	SAO
Phase 4 - Sumit 1	10,000	2018	Approved	SAO
Phase 5 - Sumit 2	10,000	2018	Approved	SAO
Phase 6 - Sumit 3	10,000	2018	Approved	SAO
DEVON CANADA CORPORATION				
Jackfish				
Devon says that Jackfish is currently producing over 40,000 barrels per day, exceeding capacity by 10 per cent. It is expected to reach 60 per cent capacity.				
Phase 1	10,000	2013	Approved	SAO
Phase 2	10,000	2014	Approved	SAO
Phase 3	10,000	2015	Approved	SAO
Jackfish East				
Expansion	10,000	2016	Approved	SAO
Elk				
Devon says the Elk project continues to move through the regulatory process.				
Elk	10,000	2016	Approved	SAO
Elk	10,000	2017	Approved	SAO
Elk	10,000	2018	Approved	SAO
GRIZZLY OIL SANDS LLC				
Algoa Lake				
Grizzly says that the Algoa Lake project is on track to start up in December 2015, followed by long production and the start of ramp-up in the first quarter of 2016.				
Phase 1	1,000	2014	Approved	SAO
Phase 2	1,000	2015	Approved	SAO
Big Bear				
Grizzly says that the Big Bear project is on track to start up in December 2015, followed by long production and the start of ramp-up in the first quarter of 2016.				
Phase 1	1,000	2014	Approved	SAO
Phase 2	1,000	2015	Approved	SAO
HARVEST OPERATIONS CORP.				
Blackfoot				
Phase 1	10,000	2014	Approved	SAO
Phase 2	10,000	2015	Approved	SAO
HUGLEY ENERGY INC.				
McMullen				
Hugley says that during the third quarter of 2013, 17 wells were drilled and one well was completed at the commercial portion of the company's McMullen play with 100,000 barrels per day from the first well and reported by the end of 2013. Construction on the second well pad commenced in the third quarter of 2013 and is expected to be finished in the fourth quarter of 2013. All the pre-regulatory work on the second well pad is complete and the company is in the process of submitting the regulatory application to the Alberta Energy Regulator to allow the second well to be brought on production.				
Phase 1	100	2012	Approved	SAO

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Lindbergh (continued)				
Phase 1	30,000	2018	Approved	SAGD
ROYAL DUTCH SHELL PLC				
Orion				
Shell had previously put up for sale its Orion asset, but says it has not received any offers that reflect its value and has ended sale activities.				
Phase 1	10,000	2007	Operating	SAGD
Phase 2	10,000	TBD	Approved	SAGD
PEACE RIVER REGION — IN SITU				
ANDORA ENERGY CORPORATION				
Sawn Lake				
Andora majority owner Pan Orient Energy says that drilling of the first SAGD well pair has been completed, final site preparation and construction is underway, and equipment for the facility is ready for installation. Steam injection at the Sawn Lake SAGD demonstration project is scheduled for the end of January 2014, with production anticipated early in the second quarter of 2014.				
Demonstration	1,400	2014	Construction	SAGD
BAYTEX ENERGY CORP.				
Cliffdale				
A hearing has wrapped up in Peace River relating to public concerns about health impacts of air pollution from bitumen storage tanks associated with Baytex's old production in the region. The hearing panel is expected to make its final comments public on the Alberta Energy Regulator website in March.				
Pilot	2,000	2011	Completed	CSS
Harmon Valley				
Pilot	TBD	2011	Operating	CSS
MURPHY OIL COMPANY LTD.				
Cadotte				
Pilot	TBD	TBD	On Hold	VSD
Seal/Cadotte				
Murphy Oil is currently running two CSS pilot wells at Seal and reports encouraging results. Murphy expects to receive regulatory approval for a third well in the second quarter of 2013, with steam injection beginning in the third quarter of 2013.				
Pilot	TBD	TBD	Operating	CSS
NORTHERN ALBERTA OIL LTD.				
Sawn Lake				
Company owner Deep Well Oil & Gas says drilling has commenced on the first of two horizontal SAGD wells (one well pair). Remaining 2013 work consists of the full construction of a steam generation facility, water handling and oil treating, along with water source and disposal well facilities. It is anticipated steam operations will commence in December 2013 with first oil production anticipated in the first quarter of 2014.				
Pilot	700	TBD	Approved	Horizontal CSS
PENN WEST PETROLEUM LTD.				
Harmon Valley South				
Penn West has announced that in 2014 it will divest its oil sands assets in the Peace River region of Alberta as part of a strategy to prioritize light oil development. These assets comprise the Peace River Oil Partnership, which was established in 2010 with an affiliate of China Investment Corporation.				
Pilot	TBD	TBD	Construction	Horizontal CSS
Seal Main				
Penn West has announced that in 2014 it will divest its oil sands assets in the Peace River region as part of a strategy to prioritize light oil development.				
Pilot	75	2011	Operating	Horizontal CSS
Commercial	10,000	2015	Approval	Horizontal CSS
PETROBANK ENERGY AND RESOURCES LTD.				
Dawson				
Petrobank has received regulatory approval to initiate two cyclic steam stimulation cycles with each of its THAI production wells. The company is preparing surface facilities for CSS operations and expects to initiate the first three-month steam cycle in late November 2013.				
Experimental THAI Demonstration	10,000	2014	Approved	THAI
Phase 2	10,000	TBD	Approved	THAI
ROYAL DUTCH SHELL PLC				
Peace River				
Shell has sanctioned the Cammon Creek project, which will be the most significant project ever undertaken in the Peace River region.				
Cadotte Lake	12,500	1986	Operating	CSS
Cammon Creek - Phase 1	40,000	2012	Construction	VSD
Cammon Creek - Phase 2	40,000	TBD	Approved	VSD
NORTH ATHABASCA REGION — UPGRADER				
BP PLC				
Terre de Grace				
BP says that ongoing appraisal activities include delineation drilling, seismic acquisition and appraisal of water sources.				
Pilot	8,400	TBD	Approved	UPG

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
CANADIAN NATURAL RESOURCES LIMITED				
Horizon				
Canadian Natural says that operating performance at Horizon has been strong since the company awarded its first major turnaround in May 2013. Horizon SCO production in the third quarter was approximately 112,000 barrels per day. The overall phased expansion to 250,000 barrels per day is 90 per cent physically complete, with the first phase in that expansion. Reliability 91 per cent physically complete and five per cent under budget.				
Phase 1	180,000	2009	Operating	UPG
Reliability - Transfer 2	5,000	2014	Construction	UPG
Phase 2A	10,000	2015	Construction	UPG
Phase 2B	45,000	2016	Construction	UPG
Phase 3	80,000	2017	Construction	UPG
IVANHOE ENERGY INC.				
Tamarack				
The Alberta Energy Regulator says it will defer decisions on applications for in situ oil sands projects in the new "shallow thermal area" of the Athabasca region until it has developed formal regulatory requirements. Ivanhoe Tamarack is one of five impacted projects.				
Phase 1	34,784	2017	Approved	UPG
SUNCOR ENERGY INC.				
Base Operations				
Suncor says that production was reduced in September as a result of planned maintenance at the Upgrader 2 vacuum tower and related units, which was successfully completed in October. Suncor says this marks the completion of major planned maintenance activities for the year and sets the foundation for a strong fourth quarter.				
U1 and U2	225,000	1967	Operating	UPG
Millennium Vacuum Unit	35,000	2005	Operating	UPG
Millennium Coker Unit	97,000	2008	Operating	UPG
SYNCRUDE CANADA LTD.				
Mildred Lake/Aurore				
Canadian Oil Sands Limited says that Syncrude has reached completion at two of four major capital projects designed to support operations and environmental performance. At the Aurore North site, two of three mine barns have been relocated to enable the placement of consolidated tailings in pit, and a new composite tailings plant has been constructed.				
Base Plant Stage 1 & 2 Debitolene k	250,000	1978	Operating	UPG
Stage 3 Expansion (U1-E)	100,000	2006	Operating	UPG
Stage 3 Debitolene k	75,000	TBD	Approved	UPG
SOUTH ATHABASCA REGION — UPGRADER				
CNOOC LIMITED				
Long Lake				
Phase 1	58,500	2009	Operating	UPG
VALUE CREATION INC.				
Advanced TriStar				
The Alberta Energy Regulator says it will defer decisions on applications for in situ oil sands projects in the new "shallow thermal area" of the Athabasca region until it has developed formal regulatory requirements. Advanced TriStar is one of five impacted projects.				
ATS-1	12,750	2016	Approval	UPG
ATS-2	25,500	2018	Approval	UPG
ATS-3	25,500	2020	Approval	UPG
TriStar				
Value Creation received regulatory approval for the TriStar project in December 2013.				
Pilot	840	TBD	Approved	UPG
INDUSTRIAL HEARTLAND REGION — UPGRADER				
NORTHWEST UPGRADING INC.				
Radwater Upgrader				
The partners say that construction activity progress continues at the Sturgeon Refinery site including rough grading, deep undergrounds, foundations and preliminary piling. The metal skin has also been installed for the first main process building. Engineering and procurement activities continue, with awards for major EPC contracts for various process units targeted to be completed by early 2014. Expected capital cost of the project has increased from \$5.7 billion to \$8.5 billion, due to a combination of cost inflation and the inability to fully capture certain cost saving initiatives.				
Phase 1	50,000	2017	Construction	UPG
Phase 2	50,000	TBD	Approved	UPG
Phase 3	50,000	TBD	Approved	UPG
SHELL ALBANY SANDS				
Scotford Upgrader 1				
Minority partner Marathon Oil Corporation says the Athabasca Oil Sands Project has recently shown "outstanding" performance due to robust reliability and realizations, but is expecting significant planned downtime in the fourth quarter.				
Commercial	150,000	2003	Operating	UPG
Expansion	100,000	2011	Operating	UPG
VALUE CREATION INC.				
Heartland				
Reports are that Value Creation could be up and running within 18 months of project sanction, but funding remains unclear.				
Phase 1	46,300	TBD	On Hold	UPG
Phase 2	46,300	TBD	Approved	UPG
Phase 3	46,300	TBD	Approved	UPG

GLOSSARY of oil sands terms

Asphaltenes

The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

Barrel

The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

Bitumen

Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

Cogeneration

The simultaneous production of electricity and steam, which is part of the operations of many oil sands projects.

Coking

An upgrading/refining process used to convert the heaviest fraction of bitumen into lighter hydrocarbons by rejecting carbon as coke. Coking can be either delayed coking (semi-batch) or fluid coking (continuous).

Condensate

Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

Conventional crude oil

Mixture of mainly pentane and heavier hydrocarbons recoverable at a well from an underground reservoir, and liquid at atmospheric pressure and temperature. Unlike bitumen, it flows through a well without stimulation and through a pipeline without processing or dilution.

Cracking

An upgrading/refining process for converting large, heavy molecules into smaller ones. Cracking processes include fluid cracking and hydrocracking.

Cyclic steam stimulation (CSS)

An in situ production method incorporating cycles of steam injection, steam soaking and oil production. The steam reduces the viscosity of the bitumen and allows it to flow to the production well.

Density

The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m³) or degrees on the American Petroleum Institute (API) gravity scale. In western Canada, oil up to 900 kg/m³ is considered light to medium crude—oil above this density is deemed as heavy oil or bitumen.

Dilbit

Bitumen that has been reduced in viscosity through addition of a diluent such as condensate or naphtha.

Diluent

A light hydrocarbon blended with bitumen to enable pipeline transport. See *Condensate*.

Extraction

A process, unique to the oil sands industry, that separates the bitumen from the oil sand using hot water, steam and caustic soda.

Froth treatment

The means to recover bitumen from the mixture of water, bitumen and solids "froth" produced in hot-water extraction (in mining-based recovery).

Gasification

A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy by-products.

Groundwater

Water accumulations below the Earth's surface that supply fresh water to wells and springs.

Heavy crude oil

Oil with a gravity below 22 degrees API. Heavy crudes must be blended or mixed with condensate to be shipped by pipeline.

Hydrocracking

Refining process for reducing heavy hydrocarbons into lighter fractions, using hydrogen and a catalyst, can also be used in upgrading bitumen.

Hydrotransport

A slurry process that transports water and oil sand through a pipeline to primary separation vessels located in an extraction plant.

Hydrotreater

An upgrading/refining process unit that reduces sulphur and nitrogen levels in crude oil fractions by catalytic addition of hydrogen.

In situ

A Latin phrase meaning "in its original place." In situ recovery refers to various drilling-based methods used to recover deeply buried bitumen deposits.

In situ combustion

An enhanced oil recovery method that works by generating combustion gases (primarily CO and CO₂) downhole, which then "push" the oil towards the recovery well.

Lease

A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Light crude oil

Liquid petroleum with a gravity of 28 degrees API or higher. A high-quality light crude oil might have a gravity of about 40 degrees API. Upgraded crude oils from the oil sands run around 30–33 degrees API (compared to 32–34 for Light Arab and 37–40 for West Texas Intermediate).

Mature fine tailings

A gel-like material resulting from the processing of clay fines contained within the oil sands.

Oil sands

Bitumen-soaked sand deposits located in three geographic regions of Alberta: Athabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total in-place deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

Overburden

A layer of sand, gravel and shale between the surface and the underlying oil sand in the mineable oil sands region that must be removed before oil sands can be mined.

Permeability

The capacity of a substance (such as rock) to transmit a fluid, such as crude oil, natural gas or water. The degree of permeability depends on the number, size and shape of the pores and/or fractures in the rock and their interconnections. It is measured by the time it takes a fluid of standard viscosity to move a given distance. The unit of permeability is the Darcy.

Petroleum coke

Solid, black hydrocarbon that is left as a residue after the more valuable hydrocarbons have been removed from the bitumen by heating the bitumen to high temperatures.

Primary production

An in situ recovery method that uses natural reservoir energy (such as gas drive, water drive and gravity drainage) to displace hydrocarbons from the reservoir into the wellbore and up to the surface. Primary production uses an artificial lift system in order to reduce the bottomhole pressure or increase the differential pressure to sustain hydrocarbon recovery, since reservoir pressure decreases with production.

Reclamation

Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

Steam assisted gravity drainage (SAGD)

An in situ production process using two closely spaced horizontal wells, one for steam injection and the other for production of the bitumen/water emulsion.

Surface mining

Operations to recover oil sands by open-pit mining using trucks and shovels. Less than 20 per cent of Alberta's oil sands resources are located close enough to the surface (within 75 metres) for mining to be economic.

Synthetic crude oil

A manufactured crude oil comprised of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

Tailings

A combination of water, sand, silt and fine clay particles that is a by-product of removing the bitumen from the oil sand through the extraction process.

Tailings settling basin

The primary purpose of the tailings settling basin is to serve as a process vessel, allowing time for tailings water to clarify and silt and clay particles to settle so that the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

Thermal recovery

Any in situ process where heat energy (generally steam) is used to reduce the viscosity of bitumen to facilitate recovery.

Upgrading

The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

Viscosity

The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.

CONTACTS

Oil Sands Producers

• Alberta Oilsands	www.aboilsands.ca
• Athabasca Oil Corporation	www.aolco.com
• Baytex Energy	www.baytex.ab.ca
• BlackPearl Resources	www.blackpearlresources.ca
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Associations/Organizations

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• Alberta Energy	www.energy.gov.ab.ca
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• Canadian Association of Petroleum Producers	www.capp.ca
• Canadian Heavy Oil Association	www.choa.ab.ca
• In Situ Oil Sands Alliance	www.losa.ca
• Lakeland Industry & Community Association	www.lica.ca
• Natural Resources Conservation Board	www.nrbc.ca
• Oil Sands Community Alliance	www.oscaalberta.ca
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• Petroleum Technology Alliance Canada	www.plac.org

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